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On a New Star in the Constellation of Orion. By Ralph Copeland, Ph.D.

On December 13, 1885, Mr. J. E. Gore. of Beltra, Ballysodare, Ireland, observing with a binocular, found a reddish star about 6 mag. some 20′ following χ' (54) *Orionis*. The star not being given by Harding, Lalande, Heis, or Birmingham, Mr. Gore suspected that it was either a "new star," or a remarkable variable. Mr. Gore's attention was attracted to it by its red colour and its absence from Harding's atlas.

On the receipt of these particulars from Mr. Gore on December 16, the star not occurring in the *Durchmusterung*, or, with certainty, in any of the usual catalogues, a telegram was immediately sent to Cambridge, U.S., and on the following day a circular giving a short account of the star was distributed by post. On the night of December 16 the star had been recognised by its orange-red colour, its place approximately laid down and the spectrum examined with a prism in front of the eyepiece as well as with a low-power spectroscope. Comparisons with neighbouring stars gave a magnitude of 6·3, from which it seems to be slowly declining, if reliance can be placed in the slight change in the following estimates:—

		Mag.			Mag.
Dec.	22	6·5	Dec.	26	6·5
	24	6·5		29	6·6
	25	6·5	Jan.	2	6·6

A prompt telegraphic response from Harvard College gave the brightness as 6·0 mag. on December 16.

At the first glance the spectrum was seen to be a specially beautiful one of type III., but it was not until a powerful compound prism was brought to bear on it on the 17th that its extraordinarily marked character was fully realised.

The large number of details thus rendered visible are shown in the following table, which gives the wave-lengths as they resulted from each set of observations, with the mean values.

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Measures of the Spectrum of the New Star in Orion.

Description of line, band, &c.	Dec. 17.		Dec. 18.		Dec. 26.			Means. m.m.m.
Spectrum begins	669 ±				671 ±			670 ±
Dusky band begins	626·9				627·1			627·0
,, ,, ends	616·4				613·5			615·0
Maximum of great bright band					611·0			611·0
Dusky band begins	597·2	593·7						595·5
,, ,, ends	587·0	585·4					583·9	585·4
Almost a bright line					584·1			584·1
Maximum in bright band	577·1							577·1
Brighter from					559·2			559·2
To the beginning of a dimmer part at					549·0			549·0
Sharp edge towards the red of a bright band; brightest part of the spectrum	544·1	542·7	542·6		541·7			542·8
The band fades away at					520·4			520·4
Dark line: darkest part of spectrum...			518·9	517·0	519·0	to	516·8	517·9
Very bright line: beginning of band	517·4	515·3	515·6		516·2		516·3	516·2
Second bright line	515·7	513·1 512·4						513·7
The band fades away, ending at	500·4		504·4		503·2			502·7
Dark line			495·5					495·5

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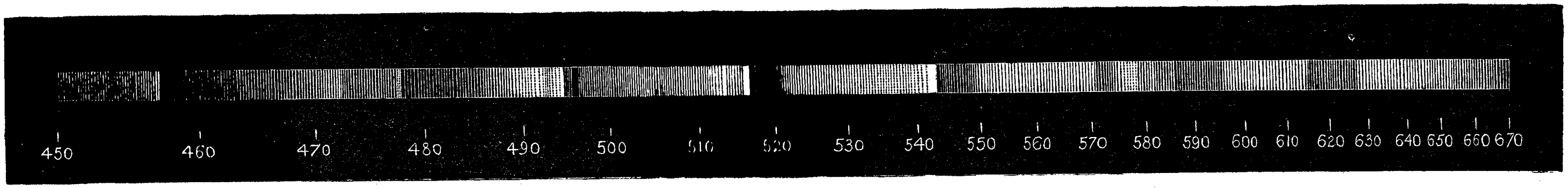
Description of line, band, &c.	Dec. 17.	Dec. 18.	Dec. 26.	Means m.m.m.
Bright line: beginning of band	494·4	493·9	494·8	494·4
Second bright line	492·3			492·3
The band fades to invisibility at	484·5		485·9	485·2
Bright line; fairly visible	478·0		477·6	477·8
Isolated bright line, just discernible				
Bright line; fairly visible	472·3		472·2	472·2
Fades off to			466·2	466·2
Faint luminous band			456·2	456·2
End of spectrum	450 ±			450 ±

The sketch gives an idea of the relative degree of brightness of the various parts of the spectrum.



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The spectrum is unmistakeably of the third type, of which *a Orionis* is the brightest member. But in this star the *bright bands* are so strikingly developed that they form the most salient parts of the spectrum. Adopting this view, an examination of the preceding numbers and the descriptions of the bands, &c., to which they refer, reveals the startling fact that this spectrum is not so much a continuous one, interrupted by dark lines and dusky bands, as *a not very luminous spectrum upon which a series of bright bands are superposed.* One of the bright bands, that beginning with the "very bright line," w.-l. 516·2 m.m.m., is most readily identifiable as the great hydro-carbon band seen in the spectrum of every comet that has been examined under favourable circumstances. This identification is strongly supported by the second bright line 513·7, which is also found both in hydro-carbon and cometary spectra. It is, however, on bringing the spectra of the star and of the blue flame of a spirit-lamp at the same time into the field of the spectroscope that their exact agreement becomes most evident. For not only do they agree perfectly in wave-length and in beginning with two plainly distinguishable bright lines, but also in the delicate gradations of light by which they similarly fade away towards the violet, thus forcing the extreme probability of a common origin upon the observer.

But the presence of luminous lines does not rest on this single band, for the second cometary and hydro-carbon band, which has its bright edge at w.-l. 472·9 (Hasselberg, *Ueber die Spectra der Cometen*), is also found in the new star's spectrum at w.-l. 472·2.

Of the three other luminous bands agreeing with the coal-gas spectrum, which were all measured at Dun Echt in that of Comet 1881, III.,[*] two lie beyond the limit to which I have yet traced the spectrum of this star, and the third, falling between w.-l. 563 and 534 in a bright and otherwise difficult part of the spectrum, has not yet made its possible presence evident.

This leaves the origin of the bright bands beginning at 542·8 and 494·4 an open question; but, excepting their general appearance, there is no reason why they should be due to the same substance as the great band at 516·2. On the other hand, the presence of the bright hydro-carbon bands in a spectrum of type III. removes any difficulty there may be in accepting Secchi's conclusion that they appear in a reversed (dark) form in spectra of type IV.

The position of the new star was determined by Dr. L. Becker with the Dun Echt transit circle of 8·6 ins. aperture, as below, the places being based on the catalogue of the *Berliner Jahrbuch*.

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[*] *Copernicus*, vol. ii. p. 227.

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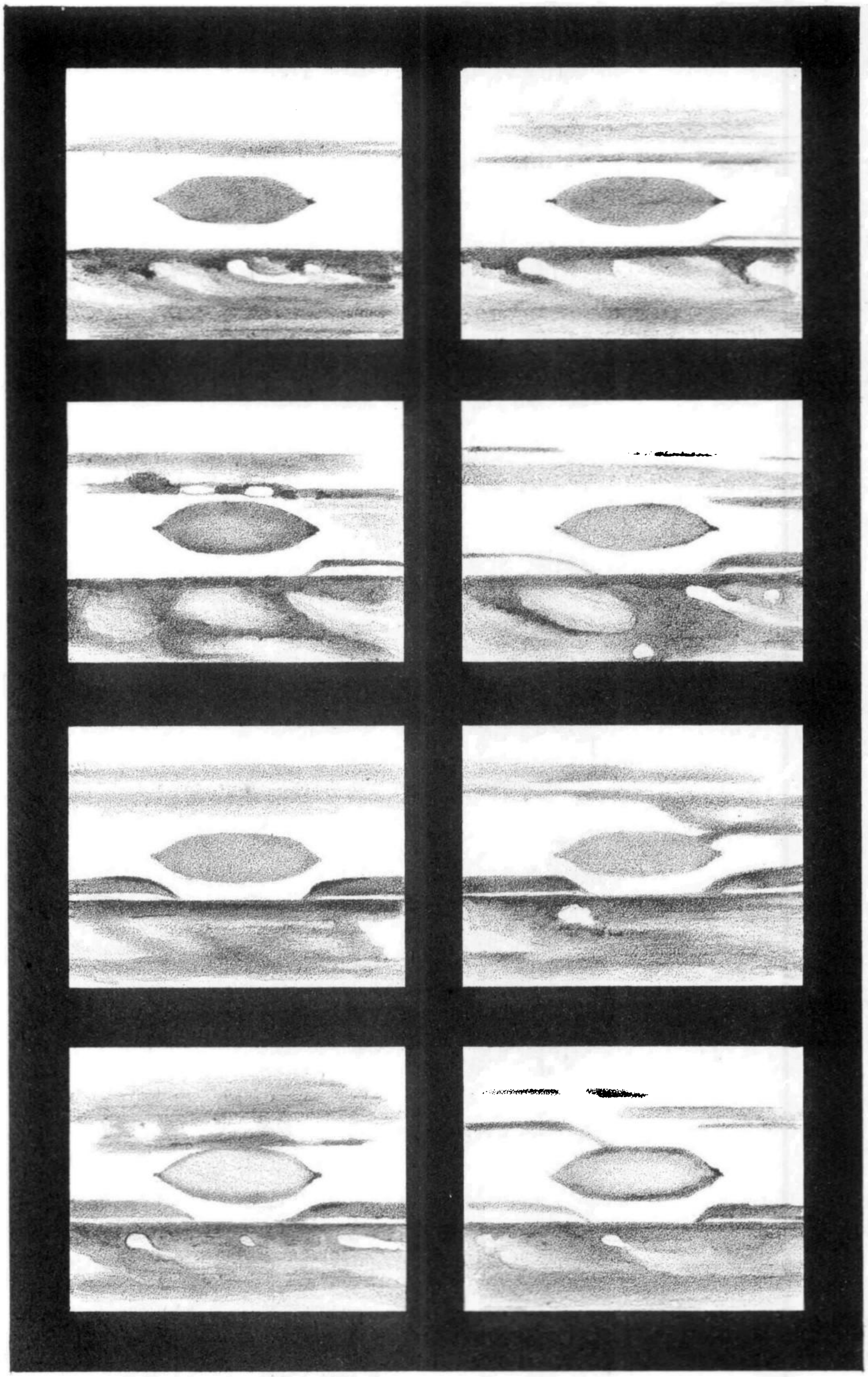
Monthly Notices of R. Astronom. Soc. Vol. XLVI. Plate 3.



Jupiter's Red Spot and the region near.

			h.	m.				h	m
1.	1880	Nov. 19.	9	23.	2	1881.	Sep. 28.	13	11.
3.	1881	Dec. 7.	10	40.	4.	1882	Oct. 30.	16	10.
5.	1883	Oct. 15.	15	37.	6.	1884.	Feb. 6.	9	29.
7.	1885	Feb. 25.	12	50.	8.	1885.	May 9.	8	8.

10 inch reflector powers 212 and 252.

W. F. Denning del.
W. H. Wesley lith.
West, Newman & Co. imp.

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1885.		Mean R.A.	Mean Decl.
		h m s	° ′ ″
Dec.	17	5 48 59·52	+20 9 13·7
	18	59·49	14·2
	22	59·49	14·5
	24	59·56	15·9
	26	59·55	13·9
Mean place 1885·0:		5 48 59·52	+20 9 14·4

On January 2, 1886, the Rev. S. J. Johnson wrote to me there was a star in Bode's Maps (1782) near the *Nova*, but which is not in the larger or smaller maps of the S.D.U.K. or any other atlas in his possession. In the description of the *Uranographie* Bode refers the star to Hevel, who gives it in the *Prodromus Astronomiæ*, on pp. 228 and 296, as "in Clavâ intermedia." It is duly entered in map Qq of the *Firmamentum Sobiescianum*,* and forms No. 1064 of Baily's edition of Hevel's Catalogue in vol. xiii. of the Society's *Memoirs*. Respecting it, Baily says: "I cannot find any star that will accord with this position; neither can I discover any observations of it in the *Machina Cœlestis*. It is not in the Index to that work. The two other neighbouring stars, which are designated by Hevelius as 'In clavâ præcedens' and 'sequens,' were observed on April 18, 1667."

Dr. L. Becker, on reducing all three stars from 1660 to the date of the *Durchmusterung*, finds:

		1855·0. Hevel.	Durchmusterung.	H−D.M.
		h m s	h m s	s
In Clavâ præcedens	α	5 45 54	5 45 48	+6
		° ′	° ′	′
	δ	+20 15·2	+20 14·8	+0·4
		h m s		
In Clavâ intermedia	α	5 51 30		
		° ′		
	δ	+20 15·1		
		h m s	h m s	s
In Clavâ sequens	α	5 55 29	5 55 19	+10
		° ′	° ′	′
	δ	+20 7·5	+20 8·4	−0·9

The Meridian observations of the new star give:—

			Hevel−Nova
		h m s	m s
Nova Orionis, 1855	α	5 47 13	+4 17
		° ′	′
	δ	+20 8·7	+ 6·4

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* The Dun Echt copy of this atlas bears the autograph "J. E. Bode, 1774, 10/24, Berlin."

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If Hevel did really observe the same star as Mr. Gore there must be an error of 1° in Hevel's observation. Hevel calls the star 7 mag., but there is no star of that size either in the Bonn maps or in the heavens with which it can be identified, without the assumption of some error.

Flamsteed measured the places of the quadrilateral of stars formed by 54, 57, 61, and 62 *Orionis* with the sextant on February 20, 1680, but makes no mention of any star inside the group.* The star does not occur in Sufi or any of the ancient catalogues.

Dun Echt Observatory:
1886, *January* 7.

Observations of the Spectrum of Nova Orionis made at the Royal Observatory, Greenwich. By E. W. Maunder.

The spectrum of the new variable, discovered by Mr. Gore near χ' *Orionis*, was examined on the evening of 1885, December 29, with the "half-prism" spectroscope reversed, and a train of one "half-prism," giving a dispersion of about 5° from A to H. A magnifying power of 28 was used upon the viewing telescope. A cylindrical lens was employed before the slit, which was not quite sufficiently narrow to separate the bright lines of the magnesium spectrum which correspond to b_2 and b_4, Slit width=0·00688 in. corresponding to about 7″ of arc.

The spectrum is an exceedingly pronounced example of Secchi's third type. The dark bands are *very* dark; the bright zones or interspaces *very* bright, and with a low dispersion would undoubtedly present the appearance of bright lines. With the dispersion employed, however, no bright lines could be detected, nor was any local irregularity of brightness, which could reasonably be suspected to be a bright line, seen anywhere; notwithstanding that, as just stated, the brilliance of the bright zones, especially close to the sharp edges of the dark bands, was very striking.

Four dark bands were very conspicuous. Adopting the numeration employed in the observations of β *Pegasi*, made on 1876, October 18, and published in the volume of Greenwich Observations for 1876, these were Bands IV., V., VI., and VII. The following three measures were obtained of the sharp, more refrangible edge of Band VI. (Band 7 in Dunér's nomenclature):—

	Wave-length. Tenth-metres.
	5167·76
	5170·29
	5170·57
Mean ...	5169·54

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* *Hist. Cœl.*, i. p. 81.